

SCIENCE AND TECHNOLOGY COMMITTEE

Second Special Report

**THE GOVERNMENT'S RESPONSE TO THE
SCIENCE AND TECHNOLOGY
COMMITTEE'S SIXTH REPORT,
SESSION 2000-01,
ARE WE REALISING OUR POTENTIAL?**

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The Science and Technology Committee

The Science and Technology Committee is appointed to examine on behalf of the House of Commons the expenditure, administration and policy of the Office of Science and Technology and its associated public bodies. Its constitution and powers are set out in House of Commons Standing Orders Nos. 137A and 152.

The Committee has a maximum of eleven members, of whom the quorum for any formal proceedings is three. The members of the Committee are appointed by the House and unless discharged remain on the Committee until the next dissolution of Parliament. The present membership of the Committee is as follows:¹

Mr Parmjit Dhanda MP (*Labour, Gloucester*)
Dr Ian Gibson MP (*Labour, Norwich North*)
Mr Tom Harris MP (*Labour, Glasgow Cathcart*)
Mr David Heath MP (*Liberal Democrat, Somerton and Frome*)
Mr Mark Hoban MP (*Conservative, Fareham*)
Dr Brian Iddon MP (*Labour, Bolton South East*)
Mr Tony McWalter MP (*Labour, Hemel Hempstead*)
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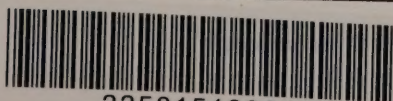
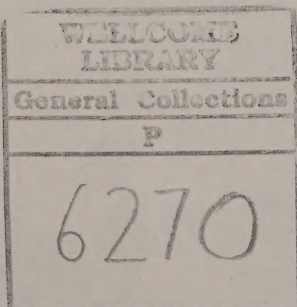
On 14 November 2001, the Committee elected Dr Ian Gibson its Chairman.

The Committee has the power to require the submission of written evidence and documents, to examine witnesses, to make Reports to the House and to appoint a sub-committee.

The Committee may meet at any time (except when Parliament is prorogued or dissolved) and at any place within the United Kingdom. The Committee may meet concurrently with other committees or sub-committees of either House of Parliament for the purposes of deliberating or taking evidence, and may exchange documents and evidence with any of these committees or sub-committees. The Committee may meet with other committees of the House of Commons for the purpose of considering draft reports.

The Reports and evidence of the Committee are published by The Stationery Office by Order of the House. All publications of the Committee (including press notices) are on the Internet at www.parliament.uk/commons/selcom/s&thome.htm.

All correspondence should be addressed to the Clerk of the Science and Technology Committee, Committee Office, 7 Millbank, London SW1P 3JA. The telephone number for general inquiries is: 020 7219 2794; the Committee's e-mail address is: scitechcom@parliament.uk.



SECOND SPECIAL REPORT

The Science and Technology Committee has agreed to the following Special Report:—

THE GOVERNMENT'S RESPONSE TO THE SCIENCE AND TECHNOLOGY COMMITTEE'S SIXTH REPORT, SESSION 2000-01, ARE WE REALISING OUR POTENTIAL?

1. The Science and Technology Committee published its Sixth Report of Session 2000-01, Are We Realising Our Potential?, on 3 April 2001 as HC 200.
2. The Government's response to the Committee's Report was received on 30 October 2001 in the form of a memorandum to the Committee. It is reproduced as an Appendix to this Special Report.

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APPENDIX

THE GOVERNMENT'S RESPONSE TO THE HOUSE OF COMMONS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY'S SIXTH REPORT: ARE WE REALISING OUR POTENTIAL?

Introduction

The Government welcomes the Committee's report *Are We Realising Our Potential?* The Government has noted the Committee's observations and recommendations which will make a helpful contribution to the Government's ongoing work on science and innovation.

The Government is firmly committed to maintaining and building on the excellence of the science base and to deriving maximum value from it. As the Committee has noted, the Government has introduced new initiatives over the past year, which were announced through Spending Review 2000 and the two White Papers *Excellence and Opportunity – a science and innovation policy for the 21st century*¹ and *Opportunity for all in a world of change*.² As the Government's memoranda to this inquiry have shown, these initiatives are underpinned by substantial amounts of new money and this underlines the Government's commitment to science. These increases in spending have been welcomed by the scientific community and the Committee.

The future of the science base depends not only on direct investment but also on stimulating an interest in science among young people. There is a need to ensure that young people are equipped with the knowledge and skills to become confident and informed users of science, and that they have a secure grounding from which they can go on to pursue scientific careers. The Government also recognises the importance of departmental research. Many of the initiatives announced in *Excellence and Opportunity* – such as the development of departmental science and innovation strategies and the implementation of stronger guidelines from the Chief Scientific Adviser³ – are intended to ensure that research plays a full and effective part in Government policy making.

The Government is pleased to have this opportunity to present some of its achievements in these areas in response to concerns that the Committee has raised, and also to describe measures that have been introduced to support science education. Nonetheless, the Government is aware that there is no room for complacency and that there is still much to be done if the full potential of science and technology is to be realised and to ensure that the UK thrives in the global knowledge economy of this new century.

That said, as stated in *Excellence and Opportunity*, policy and management for many aspects of science and innovation have been devolved to the new administrations in Scotland, Wales and Northern Ireland. While the remainder of this paper focuses largely on reserved activities, "the Government and the devolved administrations are committed to working together to translate the fruits of scientific research and invention into products and services that improve the economic and social well-being of all the people of Britain. They also recognise the need to work together to ensure that there is a strong UK Science Base supported by high quality science education, and that the public is well informed about scientific issues". The Scottish Executive has published the first comprehensive science strategy for Scotland and copies have been made available to the Committee. In Northern Ireland the Programme for Government includes a commitment to the publication of a regional *Research, Development and Innovation Strategy* by March 2002. Work is currently underway in developing the Strategy.

¹ *Excellence and Opportunity, a science and innovation policy for the 21st century*, (Cm 4814), July 2000.

² *Opportunity for all in a world of change*, (Cm 5052), February 2001.

³ *Guidelines 2000: Scientific Advice and Policy Making*, (URN 00/1026), July 2000.

The Government looks forward to continuing a constructive dialogue with the Committee and offers the following responses to the Committee's recommendations.

1. We recommend that *Forward Look* be published annually, and that it be published together with the statistical supplement. It is widely used by the science, engineering and technology community. (Paragraph 15)

2. We recommend that the next issue of *Forward Look* provide a clear statement of Government's overall strategy for science and technology and show explicitly how expenditure figures match policy objectives. We look forward to publication of the departmental strategies and trust that these will contain meaningful measures of Departments' science, engineering and technology performance. (Paragraph 16)

The Government has previously set out its rationale for publishing *Forward Look* in the year following a Spending Review, in the context of the Committee's inquiry into 'The Government's Expenditure on Research and Development – The Forward Look'. In a memorandum and two subsequent Government Responses, to the Committee's Fifth and Seventh Reports, the Government explained that:

'the purpose of *Forward Look* is to present industrial and research communities with a clear and up-to-date statement of the Government's strategy for science, engineering and technology, and a statement of the Government's expenditure in this area. In the Government's view, it makes sense to publish *Forward Look* in the year following a Spending Review, so that it can set out departmental spending plans over the period of the Review'.

The Government stands by its view that there will be little justification for publishing a full *Forward Look* in the intervening years. Any adjustments in departmental spending will be updated in the Science, Engineering and Technology Statistics (*SET Statistics*) publication and departments themselves are increasingly making such information available, especially on the Internet. *SET Statistics* is published annually by the Office of Science and Technology (OST). It brings together in one place data from a range of sources relating principally to expenditure on science, engineering and technology. At present, *SET Statistics* is published as a Command Paper and is also placed on the OST website at www.dti.gov.uk/ost/setstats. The Government would like to move, from this year, to publishing *SET Statistics* in electronic form only. The Government believes that electronic-only publishing will have significant advantages for users. In particular, it will allow for the document to be updated more frequently and with greater ease. At present, updating is constrained by the annual Command Paper publication timetable despite the fact that source data which feed *SET Statistics* become available at different times during the year. The Government believes that, by their very nature, the great majority of *SET Statistics* users are technically literate and are very likely to have Internet access and that, as a result, the costs of publishing the document on paper are probably no longer justified. It considers that adequate alternative arrangements can be made to cater for users who require paper copies.

Whilst wanting to maintain the link between *Forward Look* and the Spending Review cycle, the Government is committed to communicating plans and progress with respect to science and technology issues. The departmental science and innovation strategies being developed in accordance with the recommendations in the CST's report of S&T activity across Government⁴ are a good example. These will be very closely linked to departmental objectives and should promote a much longer term and forward looking approach to the research underpinning policy making. An important element of the strategies is a description of the process for programme evaluation to assess the quality, relevance and progress of science related activities.

As well as providing the theme for the 2001 issue of *Forward Look*, it is intended that the departmental strategies will be published and updated on their websites. This exercise marks the first point at which all departments with an interest in science and technology will have produced

⁴ Review of S&T Activity across Government. Report by the Council for Science and Technology, July 1999.

a public statement of their strategies. Collectively, the strategies should provide a clear picture of the Government's approach to the use of science and technology. Their publication will enable the wider scrutiny of funding of science related activities in the context of departmental policy objectives and overall expenditure. The Government is also looking at the feasibility and desirability of linking science and technology domains on departmental websites through a central "science in Government" portal.

3. Government must actively promote Foresight to a broad range of industrial sectors, and in particular to SMEs. The learned societies, trade associations and the regional development agencies would provide useful focal points for this activity. (Paragraph 23)

The Government shares the view that Foresight should be promoted to as many stakeholders as possible to take forward the detailed recommendations and actions arising from the work of the Foresight Panels and Task Forces. Each of the Panels has engaged with key bodies in its sector, before and after the formal consultation process. Likewise, it is part of the job of the 12 Foresight Regional Co-ordinators to embed Foresight in the Regional Innovation and Economic Strategies. In addition, a number of Foresight Training Centres are about to be launched. These will train facilitators who will in turn provide both companies and Foresight co-ordinators in business support organisations, including Business Links and sectoral and trade bodies, with training in Foresight methodologies.

4. We recommend that Government make further use of Foresight in developing a coherent science, engineering and technology policy within and between Departments. (Paragraph 24)

The Foresight Directorate is at the heart of the Office of Science and Technology and is already part of the Government's trans-departmental SET policy-making machinery. During the next phase of the current round of Foresight (from now until 2004) the Panels and the Directorate will seek to implement the recommendations and actions resulting from the 2000 consultation process. This will ensure that the key messages that arise from Foresight will be targeted to reach the key players in Government and other central stakeholders.

5. On balance, Foresight has fallen short of its aims. It has the potential to be a valuable exercise but to date it has been disappointing. The quality of the second round reports is said to be variable. We look forward to the outcome of the review of Foresight being undertaken by the Minister for Science. In our view, Foresight needs to be refocused and revitalised. (Paragraph 25)

The Government welcomes the Committee's support for the Foresight review. The purpose of the review is to help focus Foresight for the rest of the current round and to make recommendations for the future of the programme. In particular it is considering whether:

- the aims and objectives are properly focused;
- the objectives have been met so far in the present round; and
- the programme is properly structured and resourced.

The review will be a two-stage process. The first stage, which ran until the end of May, is to seek general views on the programme and the second is to consult on changes coming from that process.

Nevertheless, irrespective of the quality of the second round reports, many successful new networks have been established and this in itself is a valuable outcome.

6. The creation of the post of the Director General of the Research Councils appears to have been very successful. We regret, however, that the DGRC has become less visible of late: the post would benefit from a higher profile. (Paragraph 27)

7. We see no need at present for an "Expert Advisory Group" to advise the DGRC. (Paragraph 28)

8. The re-organisation of the Research Councils has proved a success. (Paragraph 30)

9. We recommend that the Director General of the Research Councils monitor closely interdisciplinary areas which cross council boundaries. The Research Councils should exchange best practice, looking where appropriate to remove unnecessary variations in working methods. (Paragraph 31)

10. The Research Councils seem to have got the balance about right, treating wealth creation and quality of life as secondary criteria to scientific excellence. (Paragraph 32)

11. We welcome the proposed change to the status of the Council for the Central Laboratory of the Research Councils, to bring it under the joint ownership of the grant awarding Research Councils. (Paragraph 33)

12. We look forward with interest to the outcome of the quinquennial review of the Research Councils. (Paragraph 34)

The Government is pleased to note that the Committee has recognised that the changes to the overall organisation of the Research Councils and the creation of the role of the Director General of the Research Councils (DGRC) have been successful.

As stated in the report, the DGRC is taking a close interest in cross council collaboration and meets monthly with the Chief Executives of the Research Councils (CERCs) as part of this process. The recent science budget settlement, under Spending Review 2000, included the creation of three cross council programmes: e-science, basic technology and post-genomics. These programmes have been established with cross council co-ordination and management structures, and CERCs will be monitoring the success of these arrangements in order to identify best practice.

The quinquennial review of the Research Councils is addressing the opportunities for enhancing co-ordination between councils, and their collective interaction with DGRC, as a means to further improve their effectiveness in identifying and supporting national science priorities, especially those of an interdisciplinary nature.

13. We consider that further efforts should be made to disseminate the Council for Science and Technology's work more widely. (Paragraph 37)

14. The Government should give more prominence to the activities of the Council for Science and Technology and respond to its recommendations. (Paragraph 38)

The Government values the work and advice of the Council, which is promulgated widely within and outside Departments. It also gives due recognition and prominence to the Council's distinctive and influential contribution to science, technology and innovation policies, as shown clearly over the past 12 months by the two White Papers, entitled *Excellence and Opportunity* and *Opportunity for in all a world of change*.

The Government is therefore pleased to take this further opportunity to acknowledge the Council's progress and performance following its re-establishment in 1998. The Council's standing and profile will continue to strengthen as its role and work develops, and its interactions with external organisations become more extensive.

As the Committee has noted, the Council's work and advice is published openly on its web site in considerable detail. Additionally, printed copies of its substantive reports are distributed to all interested parties within and outside Government. Furthermore, the Government normally issues a press release when such reports are published.

The Government's regular practice is to respond to each of these reports and to publish the responses on the Council's web site. Normally, the timing for these responses is discussed and agreed with the Council so that it can take into account relevant policy developments. The Council is also provided with the opportunity to consider and discuss the responses, and to determine any further follow up actions that its independent members might wish to take for monitoring or other purposes.

Regarding the Council's wide-ranging report of March 2000 on *Technology Matters*, the Government provided its response for members' consideration at their meeting on 5 March 2001. This timing had been agreed previously by members so that they could take account of the Skills, Enterprise and Innovation White Paper, *Opportunity for all in a world of change*, which was published a few weeks before. This response, along with the Council's Annual Report for the year ending March 2001, has now been published on its web site.

15. Universities have improved their technology transfer capabilities and links with industry. (Paragraph 42)

16. We recommend that the Government encourage greater collaboration and joint working to develop best practice on technology transfer across universities and to enhance the commercial exploitation of research. (Paragraph 42)

Different Higher Education Institutions (HEIs) have different contributions to make, some as world class centres of research excellence and players in global markets, others primarily as collaborators with local businesses and communities and with regional actors. They must choose the role which best suits their strengths, with public funding encouraging such choice by providing incentives for institutions to become more entrepreneurial, to build closer links with business and the community and to have proper arrangements for exploiting the results of their work.

As the Committee has suggested, there are some notable university based centres of expertise in knowledge transfer and evidence of increased links with business and developing capability. Government measures such as the Higher Education Reach to Business and the Community Fund (HEROBC) have sought to help raise the academic credibility of knowledge transfer activities.

The Government agrees that further institutional and cultural change is necessary and that this will not happen overnight. However, it believes that the establishment of a permanent third stream of funding for HEIs to support their knowledge transfer activities, the Higher Education Innovation Fund (HEIF), will be a significant incentive for step change. HEIF will incorporate the existing HEROBC scheme and an additional £80 million will bring the total funding available to £140 million over the next three years. HEIF will continue to support the development of HEIs' ability to interact with business and will also provide a source of funding to support the setting up of further University Innovation Centres along the lines of those announced in the recent White Paper *Opportunity for all in a world of change*.

The Government has announced the call for proposals for the second rounds of Science Enterprise Challenge and University Challenge. These competitions are aimed at encouraging entrepreneurship and commercialisation of research, and have successful track records. The Science Enterprise Challenge has already led to the establishment of twelve Science Enterprise Centres in UK universities, involving collaboration among a total of 34 HEIs. The University Challenge has resulted in the creation of 15 seed funds managed by universities in the UK, with a total value of over £60 million, including £25 million in Government funding. Some straightforward practical measures are also being taken. For example, a web based brokering

service was launched on 23 May 2001 to help match universities having technology available to exploit with entrepreneurs looking for development opportunities. The University Technology Directory can be accessed from the Association of University Research and Industry Links (AURIL) website at www.auril.org.uk.

The Government notes the Committee's concern over possible skills shortage. As announced in the *Excellence and Opportunity* White Paper, the Government intends to work with universities, public sector research establishments and other interested bodies to review how best to stimulate the provision of training for people working in this field. The Government also notes the Committee's recommendation that there should be greater encouragement of collaboration and joint working to develop best practice on technology transfer across universities. This is envisaged in the consultation document on the design and scope of HEIF.

17. In the longer term Government should look to rationalise the plethora of technology transfer schemes aiming to develop a simplified, flexible unbureaucratic approach. (Paragraph 43)

18. Ministers should resist the temptation to launch new schemes when it would be better to strengthen existing ones. (Paragraph 43)

23. In the longer term Government should look to rationalise the network of innovation support schemes. (Paragraph 49)

The Government runs a number of long-standing schemes to assist knowledge transfer between the research community and business which meet a variety of needs. It is keeping the issue of whether these can be simplified and improved under review. In many cases, existing schemes have been strengthened, for example LINK and Smart (Small Firms Merit Award for Research and Technology), or are being streamlined, for example support for knowledge transfer between HEIs and the community at large will be consolidated into HEIF. The Government acknowledged in the recent white paper *Opportunity for all in a world of change* the need to deliver support more quickly and with less bureaucracy, taking full advantage of advances in technology and to market support in a way which responds more directly to business needs. The third round of Foresight LINK Awards included a pilot process for speeding up decision making. The results of an evaluation of this process will feed into a strategic review of LINK expected to report in Spring 2002.

19. We recommend that the Government develop an overarching strategy for technology transfer activities and publish a framework to be actively promoted to all interested parties. (Paragraph 44)

The strategic direction of knowledge transfer activities is set out in the Government's science and innovation strategies. The Government has also set up a knowledge transfer group, made up of DTI and DfES officials and representatives of interested parties such as the Research Councils, the Regional Development Agencies and the CBI. This is considering knowledge transfer policy and the development of a strategy to rationalise DTI activities at the HEI-business interface.

20. We recommend that Government promote secondment schemes more actively and consider expanding those already in existence. (Paragraph 45)

The Government agrees that there is a need to highlight the benefits of secondments between academia and business. The recently launched Business Fellowships initiative was designed with the aim of raising the profile of the people dimension of knowledge transfer. It is also intended to build on universities' existing HEROBC projects to raise the academic credibility of collaboration with business. Similar activities will also be fundable under HEIF.

The December 1998 Competitiveness White Paper, *Our Competitive Future – Building the Knowledge Driven Economy*, contained a commitment by DTI to double its expenditure on TCS (previously known as the Teaching Company Scheme). As a result it is expected that there will be close on 1,000 TCS Programmes current by the end of 2001. The graduates who undertake the project work in participating companies as TCS Associates are supported both by the company and by academic staff. This requires the academic partner in every TCS Programme to spend on average at least half a day per week at the company supervising the Associate and their project, thus providing the opportunity to transfer and implant their own knowledge into the company. As of 31 March 2001, there were 406 academic departments from 98 different HEIs participating in TCS, of which 71 departments were participating in TCS for the first time. Around 80% of TCS Programmes result in plans for further collaboration between the company and academic partners.

21. Universities must protect their intellectual property appropriately, in the long term interest of both the university and the UK as a whole. The funding regime may need to be changed to allow the universities to take a longer term perspective. (Paragraph 46)

As it has noted before, the Government strongly agrees that universities need to protect their intellectual property appropriately. Universities need to be able to establish arrangements which give all parties incentives to develop, protect and exploit intellectual property in a way which serves the long term interests of universities without them being deflected from their traditional roles of research and teaching. This in turn depends on a clear understanding within universities of intellectual property and the issues it raises, and of the range of options for commercialising the results of research. This is why the Government is working with AURIL and Universities UK (UUK) to develop best practice guidance which will heighten awareness of what makes for successful commercialisation of intellectual property.

The Government is keen to help institutions in order to ensure effective transfer of higher education knowledge and expertise to achieve long-term economic and social benefits. That is why the support available for knowledge transfer is also being increased. As already stated in response to recommendations 15 and 16, £80 million is being provided by OST through the HEIF in England over the next three years to help institutions build capacity in this area. There are also further rounds of University Challenge and Science Enterprise Challenge, and the number of Faraday Partnerships is being increased.

22. The management of intellectual property is critical if the UK is to be competitive in the global knowledge driven economy. (Paragraph 47)

The Government agrees. It notes the Committee's welcome for measures outlined in *Excellence and Opportunity*. The aim is not only that universities and research establishments should make full use of the intellectual property system, but that their use of the system should be driven by the objective of maximising successful commercialisation of the results of research. That is the purpose of these measures and the AURIL guidelines for universities mentioned above.

23. In the longer term Government should look to rationalise the network of innovation support schemes. (Paragraph 49)

See above.

24. We recommend that the Government publish a guide outlining the schemes available to SMEs and actively promote these schemes, for example through the Regional Development Agencies and trade associations. (Paragraph 49)

The Small Business Service will maintain up-to-date information on Government schemes available to SMEs as part of its Gateway service at www.businesslink.org.uk. This service will be widely marketed to SMEs and their advisers. In addition, SMEs are encouraged to speak to

Business Link Advisers who can help them find the most appropriate sources of help and advice available in their locality.

25. We welcome the Government's introduction of measures to support innovative small businesses. (Paragraph 50)

The support of innovative small businesses is, and will continue to be, an important part of the work of the Small Business Service, its network of local Business Link Operators and the specialist sponsor directorates of DTI.

26. We welcome the fiscal measures introduced in the Budget to encourage research and development and recommend that uptake be carefully monitored. Government should also conduct a proactive campaign to promote innovation among those parts of industry which are not traditionally strong in R&D. (Paragraph 51)

The Government agrees that any research and development (R&D) tax incentive for companies should be evaluated and uptake carefully monitored. R&D tax credits for SMEs were introduced in the Finance Act 2000, and figures for this scheme will be available in 2002, when companies incurring R&D expenditure have sent in their tax returns for the first year of operation of the scheme. Consultation on tax credit for larger firms' R&D was announced in Budget 2001, and the Government is considering the results of the consultation exercise. The Chancellor of the Exchequer has indicated that the Government's conclusions will be made known in his Pre-Budget Report.

The Government also agrees that it should promote innovation. This is done through direct measures to create incentives for R&D, such as the R&D tax measures, which in turn will be promoted through a pro-active campaign. In addition, the Government provides support for a number of activities to encourage business innovation, for example through collaborative R&D. The Government also publishes annually the R&D Scoreboard, which highlights to a wide range of FTSE industrial sectors the importance of R&D and innovation as key drivers for business growth.

27. There needs to be better dialogue between scientists and the public. (Paragraph 53)

The Government continues to work with others to help facilitate this dialogue. Scientists need to feel equipped to play their part. In this regard, and with the OST's encouragement, the Research Councils are strengthening and broadening communication training. Following its recent review of its research funding, HEFCE is working to improve standards in the provision of research training, including broader personal and transferable (including communication) skills.

The Wellcome Trust report, *The Role of Scientists in Public Debate*, which presents the results of a nation-wide survey of scientists' views on communicating their work to the public, provides useful pointers on how dialogue between scientists and the public might be improved.

The Government recognises the importance of engaging the public in debate on important scientific issues, particularly those which impact on society or raise ethical questions. A number of substantial measures aimed at achieving this and making public dialogue a normal and integral part of the process by which scientists provide advice to Government have been initiated.

Regular consultation and an open meeting policy are important aspects of the remits of the Food Standards Agency, the Human Genetics Commission and the Agriculture and Environment Biotechnology Commission. This approach demonstrates ongoing commitment of these three bodies to listening to the public and taking account of their views.

In addition the Code of Practice for Scientific Advisory Committees, shortly to be published, will make clear that all scientific committees should consult with stakeholders and the public, particularly on issues which generate widespread public concern or raise significant ethical questions. The Government believes that this, together with other provisions in the Code and *Guidelines 2000*, represent further significant steps.

28. We welcome the increasing use of the term “Science and Society” or, even better, “Science for Society”, to describe activities to promote dialogue and mutual understanding between the scientific community and the public. (Paragraph 55)

The Government agrees. It is important that all members of society are given the opportunity to take part in the debate about the issues that modern science raises.

The Government recognises the need to better understand the public’s attitudes to science and how they wish to be engaged on scientific issues. The OST/Wellcome Trust report *Science and the Public*, published in October 2000, is important in this regard. It includes results of a national survey into public attitudes to science which suggest that the British public is basically pro-science. The survey also provides useful pointers on the public’s preferred methods of engagement on scientific issues. The science communication community is now considering how best to make use of this information. For example, the Research Councils and OST will be funding further research into how this, and similar, information might best inform their own science communication programmes. In OST’s case, this will feed into the review of its programme.

As stated in the *Excellence and Opportunity* White Paper, it is important that there are plenty of opportunities for the public to learn about and debate scientific developments. The Government, working with, and through, others such as the Research Councils, science centres, Science Year, the British Association for the Advancement of Science (BA), the Committee on the Public Understanding of Science (COPUS) and the Learned Societies, will play its part in creating these opportunities.

Knowledge and understanding in the *social* sciences is as important as in the natural sciences in order to improve the level of quantitative and qualitative skills for analysis of social and economic issues. The Economic and Social Research Council has taken a number of steps to improve the standard of social science teaching in Britain, and to enhance the skills that are necessary for the rigorous analysis of public policy.

29. We recommend that the Government work with the scientific community to build a new strategy for promoting science and technology, building upon the work already being done but reaching out to a broader range of participants and a wider audience. (Paragraph 56)

As stated above, the Government will continue to work with the Research Councils, the BA, Learned Societies and many others to bring coherence to the UK science communication effort. It believes that the remodeled COPUS will play a key role in developing the strategy recommended by the Committee. COPUS’s new Council will be broader and more representative of the science communication community. The Government hopes that it will, among other things, address overlaps and gaps in provision. The OST/Wellcome Trust report, *Science and the Public* provides useful pointers on this.

30. We regret the move towards generalist science courses, which we fear will dilute the knowledge base and result in inadequate preparation for higher education in the sciences. (Paragraph 57)

All 5-16 year olds study an equal balance of biology, chemistry and physics, with the majority (77% in 2000) taking the double award science at GCSE. A revised curriculum was introduced in September 2000. The changes in science were designed to clarify and strengthen experimental

and investigative science, to place greater emphasis on contemporary science and on applications of science.

The double award GCSE, which is generally delivered using 20% of curriculum time, enables pupils to gain a balanced scientific education whilst also allowing the time to study a broader curriculum. The GSCE double award in science provides a secure grounding for pupils to progress to AS and A level. The Government assumes that the Committee would prefer pupils to study separate sciences at GCSE level. With current GCSE specifications, this could theoretically be achieved in two ways:

- All pupils could study three separate sciences to GCSE, which would take approximately 30% of curriculum time. While this would enable pupils to study science in more depth, it would narrow the curriculum by limiting the range of non-science subjects that pupils could study.
- Pupils could choose to specialise in one or two areas of science, as occurred prior to the introduction of the National Curriculum. The Government believes that it is important for all pupils to receive a balanced science education to age 16. This provides both a general understanding on which 'non-scientists' can draw in later life and a secure grounding for those who wish to continue with further study. The Government has also been pleased to see a gradual reduction in the gender divide post-16. Passes awarded for A level chemistry are now evenly split between males and females. A concern would be that allowing pupils to opt out of certain areas of science at age 14 would resurrect the gender divide.

The Government does not consider that either of these options would be a positive move forwards. However, the Qualifications and Curriculum Authority (QCA) has been asked to consider whether the current science curriculum best meets the needs of pupils in the 21st century. It will report to DfES in 2002.

31. The quality of science teaching in schools has become a major concern. (Paragraph 58)

34. It is essential that the Government develop a clear strategy for improving the quality of science teaching in all schools... (Paragraph 60)

The Government notes the Committee's concerns about the quality of science teaching in schools.

Performance in primary science is outstanding. Since 1997 the number of pupils achieving national expectations at age 11 has increased from 69% to 85%. Ofsted has highlighted that the national literacy and numeracy strategies have led to clear benefits in other subjects, including science, and reports that science teaching at ages 11-16 is at least satisfactory in 9 out of 10 lessons and good or very good in 6 out of 10.

To build on this, and to ensure that science teachers have access to the support they need and to high quality professional development, the Government will establish a Centre of Excellence for Science Teaching. The Centre will provide leading edge professional development for science teachers to enable them to develop their professional skills and their knowledge of up-to-date scientific advances. It will also act as the hub of a network linking together schools and higher education providers of science teacher training. In addition, the Government is piloting a Key Stage 3 strategy. The science strand of this strategy will roll out nationally in 2002/03 and will provide focused professional development for all Key Stage 3 science teachers in both pedagogical and subject knowledge. They will receive comprehensive and high quality training that will help to ensure that pupils' progress and learning in Key Stage 3 science is enhanced. 'Learning and Teaching', a strategy for professional development, was launched on 1 March 2001 (see http://www.dfes.gov.uk/teachers/cpd/docs/CPD_Strategy.pdf). The strategy is designed to give all teachers greatly increased opportunities for relevant, focused, effective

professional development, and to place such development at the heart of school improvement. A science teacher who identifies a need to develop their subject or pedagogical knowledge will select the most appropriate professional development activity to enable them to do this. This could take place in school or be facilitated by the range of providers that deliver science specific continuing professional development to teachers. Science Year was launched on 7 September 2001 with the aim of increasing engagement with science and science-based learning. It is targeted primarily at 10-19 year olds and those who influence them, including teachers. The Year is being delivered by NESTA on behalf of the DfES and they are working closely with the Association for Science Education to develop materials and resources for schools. The Government hopes that the Year will have a sustainable impact.

34. ... providing for both teachers and students to gain experience of science and technology in "the real world". (Paragraph 60)

The Government wants all children to have access to a range of high quality, focused, structured experiences of the world of work throughout their school career. This includes activities that support the teaching and learning of science and technology. The Government also recognises the importance of providing teachers with access to similar experiences.

As from April 2001, the Learning and Skills Council (LSC) has been responsible for ensuring the provision of education business link activity in each of the 47 local LSC areas. To help the LSC meet its responsibility, consortia of education business link organisations have been formed in each LSC area. By providing a single face to both schools and businesses, Education Business Link Consortia should make it easier for both parties to engage in this activity. The consortia will deliver a full range of high quality activities to all children and their teachers, including the wide range of science and technology related education business link programmes and initiatives that already exist.

Professional Development Placements offer opportunities for teachers, as part of their continuing professional development, to update their subject knowledge and increase their understanding of employers' needs. Science teachers are included in the priority group which LSCs and Education Business Link Consortia have been asked to target.

The total core funding allocated to the LSC for education business links in 2001/02 is £23 million. This will be followed by £25 million in 2002/03 and 2003/04. In addition, the LSC will be able to use its Local Initiatives Fund to supplement core funding. DTI are investing £6 million over the next 3 years to provide every child under 16 in the UK with the opportunity to participate in an appropriate STEM (Science, Technology, Engineering and Maths) activity, at least once in each Key Stage, or the equivalent, over the next three years.

32. We note that the House of Lords Committee highlights the decline in the amount of practical work in its recent Report on Science in Schools, and recommends that continuing professional development for teachers should be specifically targeted at the problem of declining practical work. We wholeheartedly endorse these views. (Paragraph 58)

Despite the Committee's observations, there is no evidence that practical work in schools is declining. The Third International Mathematics and Science Study Re-run, published in December 2000, shows that pupils in England do more practical work than their counterparts in many other countries. The importance of scientific enquiry has been further strengthened by recent changes to the National Curriculum. Well-taught practical work, including demonstration, group work and individual investigation, is an essential and valuable part of every child's science education.

The Health and Safety Executive (HSE) is keen that practical work should not be hindered by over-stringent application of health and safety regulations which is not justified by the legislation. The new health and safety statement in Curriculum 2000 clearly identifies the need for students to be taught the skills of risk assessment, and joint guidance for teachers was

prepared by the HSE and QCA. HSE is now working at other methods of informing teachers about the statement and what it means, such as producing support materials and influencing the materials produced by a wide variety of educational stakeholders.

If individual teachers or schools identify a need for further development in delivering safe and effective practical work, there are a range of providers who offer this, as well as the expertise within their own and neighbouring schools on which they can draw.

33. How to attract high quality science and technology graduates into teaching is a real problem, to which there is no ready answer. Nevertheless, it is a matter which has to be addressed as a matter of urgency. (Paragraph 59)

The Government is working hard to increase recruitment for science and technology and teacher training and the Committee has noted the £10,000 training package. Most science teachers qualify by taking a postgraduate course of initial teacher training. Between 1999 and 2001 there was a 5% rise in the number of graduates training to be science teachers. In a buoyant graduate labour market, this is good progress after several successive years of decline. By the end of March 2001, there had been a 26% increase in applications for science PGCE training places, including 20% for physics and 20% for chemistry, compared to the same time last year. The Green Paper, *Schools: Building on Success*, also contains a proposal for the Government to pay off, over time, the student loans of newly-qualified teachers of shortage subjects, including science, who commit themselves to teaching careers in the maintained sector.

In addition, the Government is strengthening employment-based training options. Schools employing trainees on the Graduate Teacher Programme now receive grants of up to £13,000 in a full year in respect of each trainee, effectively making the trainees supernumerary. This programme allows graduates to qualify as teachers while working in the classroom. It has proved especially helpful to schools with hard-to-fill vacancies and for mature trainees who are career-changers. Following the March 2001 budget, the Secretary of State announced that 2,250 fully-funded places a year would be available on the programme. Applicants in the shortage subjects, including science, receive priority for funding.

The Government is also encouraging trained teachers to return to the profession. In particular, it is currently consulting the School Teachers' Review Body on proposals for a Welcome Back bonus for people who return to teaching in the maintained sector between 17 April and 31 December 2001. Under the proposals a higher rate of bonus (£4,000) would be paid to teachers in shortage subjects, including science.

The teachers' pay award for 1 April 2001 included, within its 4.2% overall cost, a 6% increase in starting pay and 30% increases in London allowances. In addition, schools now have 5 recruitment and retention allowances, worth up to £5,000 per annum, available for use at their discretion. These may be paid in the normal way or as "golden handcuffs" at the end of a period of unbroken employment, and they may be used to attract and retain science teachers.

'Learning and Teaching', a strategy for professional development, was launched on 1 March 2001. Evidence already shows that schools with strong cultures of continuing professional development find it easier to recruit and retain staff

The Committee suggested that industry should be encouraged to contribute to the delivery of science and technology in schools. As part of Science Year, the Government will be launching a Science and Engineering Ambassadors Scheme that will encourage scientists and engineers from industry to form links with schools where they will work with both pupils and teachers.

34. It is essential that the Government develop a clear strategy for improving the quality of science teaching in all schools providing for both teachers and students to gain experience of science and technology in "the real world". (Paragraph 60)

See above

35. The inconsistency in the PhD stipend paid by different Research Councils and by independent agencies is unfair and is likely to be distorting, given the current levels of post-doctoral research salaries. (Paragraph 65)

36. We welcome the very significant increase in the minimum PhD student stipend, but we believe that it is still not enough to ensure that the best graduates stay on to do doctoral research. The Government should work towards a further significant increase in the PhD student stipend. (Paragraph 66)

37. While the increase to the PhD stipend is welcome, a more serious problem lies with the pay and conditions for post-doctoral scientists. (Paragraph 67)

38. The Government can no longer afford to ignore the problem of low pay and poor job security for post-doctoral researchers and support staff. A shortage of skilled personnel threatens to undermine its commitment to strengthening the science base. (Paragraph 67)

39. What is important is to build on the strengths of the individual and to accord equal value, and rewards, to both teaching and research. (Paragraph 68)

40. We must do more to support excellent scientists and engineers. (Paragraph 69)

Surveys have not so far suggested across-the-board problems in recruiting high-quality students to PhDs, but take-up is difficult in some subject areas. The Government is not able to prescribe the level at which other agencies support PhDs, and, in view of the pattern of take-up, is not currently minded to do so, other than setting a minimum, for the Research Councils.

The Government agrees that improvement to postdoctoral research careers is highly desirable. Primary responsibility must, however, lie with academia itself and university employers. Reinforcing other measures already taken to encourage improvement, the Government is now considering the large number of responses received, including many from the higher education sector, to its recent consultation on proposals to implement the European Community directive on fixed-term work. This aims to prevent fixed-term employees generally from being less favourably treated than similar permanent employees, limit the scope for using a series of fixed-term contracts to employ the same person in a “permanent” position, and improve access to training and information on permanent jobs for fixed-term employees. In addition, as a result of the last Spending Review, the Government has made substantial additional resources available to the higher education sector to support increases in academic and non-academic pay, to help institutions recruit and retain the key staff they need, and to help modernise management and reward systems.

As the Committee notes, the Government has asked Sir Gareth Roberts to undertake a review of the supply of skilled scientists and engineers in the UK, focusing on the sort of high-level scientific and technical skills that are possessed by postgraduates and, to a lesser extent, by well-qualified graduates. The aim of the review is to ensure that businesses can recruit and retain the scientists and engineers necessary to lead and underpin their research and development activities. The Quinquennial Review of the Research Councils is considering the Councils’ role in postgraduate training and research support generally, and the Research Careers Initiative Strategy Group, also chaired by Sir Gareth Roberts, will be delivering a further report later this year on progress in improving research careers in higher education.

The Government will take the Committee’s recommendations into account alongside those emerging from these further studies.

41. The Government must ensure that schemes to encourage experienced entrepreneurs from abroad to come to the UK are not undermined by tax disincentives. (Paragraph 70)

In Budget 2000, the Government introduced tax-favoured Enterprise Management Initiatives (EMIs) to help small, higher risk companies to recruit and retain the people they need to achieve their potential for growth, through the award of share options. Further improvements were made in Budget 2001, removing the limit on the number of employees who can benefit from the initiative and doubling the maximum value of options to £3 million per company.

42. We welcome the Government's commitment to improving opportunities for women in science, engineering and technology. (Paragraph 74)

43. It is clear that there are still barriers to women realising their potential in science, engineering and technology. (Paragraph 74)

The Promoting SET for Women Unit in the Office of Science and Technology continues to support projects such as ATHENA, which seeks to tackle inequality of opportunity and treatment for women in the higher education sector. It also brings the expertise of the social science community to bear to help address the barriers to women's progression, in particular in higher education.

One of the key barriers for women is the low rate of adoption of good work-life balance practices in the SET sector. Tackling this will represent a significant challenge over the coming years, as will ensuring that the issue of increasing the role of women in SET becomes part of the mainstream of policy-making.

In schools, there has been some progress in encouraging more girls to study chemistry in recent years, to the extent that it is expected that this year nearly half of all A-level chemistry candidates will be girls. This increase at A-level is feeding through to undergraduate degree courses. It is now important that successes in chemistry be repeated in other subjects where progress has been slow or absent, such as physics and design and technology.

The Stevens Report on the Information Technology, Electronics and Communications industries focused on the likely development of a skills shortage in the sector. It has recommended a number of measures to increase the participation by girls including the establishment of girl-only computer clubs and research on the image and perception of information technology among young people.

44. We stand by our view that the Office of Science and Technology should remain with the Department of Trade and Industry, and that the Minister for Science should be raised to Cabinet rank. (Paragraph 75)

The Government agrees with the Committee that there are advantages to locating the OST within the DTI, in particular that it allows science and technology policies to be developed more closely alongside policies on innovation. *Excellence and Opportunity – a science and innovation policy for the 21st century* is an example of this approach. In addition, the recent White Paper on enterprise, skills and innovation, *Opportunity for all in a world of change*, contained a significant SET component. The OST has retained strong links with DfES and, as the Committee acknowledges, the links between science policy, higher education policy and management of the universities have not suffered.

The Minister for Science has day to day responsibility for science policy. The Secretary of State for Trade and Industry argues the case for science in the Cabinet. The Government believes that this present arrangement works well.

45. We hope that the departmental science strategies, which are expected to be published in the Summer of 2001, will demonstrate that departments are committing additional funding to research and development. The publication of Forward Look 2001 also provides an opportunity for Government to show the impact of the 2000 Spending Review on overall government expenditure on R&D. (Paragraph 76)

The departmental science and innovation strategies will set out the broad framework within which research programmes and other science related activities are carried out. Rather than specifying funding arrangements, the strategies will demonstrate departments' commitment to optimising the use of science and technology to meet their policy objectives, not only in the short and medium term but in the longer term as well. Funding decisions will flow from departments demonstrating the value added by science related activities to achieving goals and meeting objectives. Some departments have already published their strategies; there may be some delay for areas such as agriculture and environment which have undergone significant changes following the General Election.

The publication of Forward Look 2001 will set out departmental spending plans and the Government's planned investment in the science base arising from the Spending Review 2000. Last year's cross-cutting appraisal of scientific research and the subsequent Spending Review should help to provide some stability over the next 3 years, with some departments anticipating a real terms rise in expenditure on research and development. The publication of Forward Look 2001 is also delayed until new responsibilities and spending plans can be reflected.

46. If public confidence in science is to be restored, it is essential that Government Departments have sufficient well-qualified scientific staff in-house to advise on scientific matters and to ensure that Government is able to make full use of science and technology; and there must be mechanisms to ensure that their advice is taken into account by policymakers. (Paragraph 77)

The Government agrees that it has a responsibility to maintain sufficient in-house expertise and scientific literacy to provide sound advice and to be able to respond to advice from sources outside Government. The Nicholson report of science and technology activities across Government recommended that Ministers needed to ensure that their departments had high quality people with scientific and technical backgrounds to understand science issues, to evaluate advice, and to interpret scientific issues simply and clearly. This recommendation was accepted in the Government's response, which included a commitment for departments to review present and future requirements and supply arrangements. This process is underway.

The need for departments to retain sufficient expertise in-house was also highlighted in the Phillips report of the BSE inquiry⁵. The inquiry found that Government should:

"... retain "in house" sufficient expertise to ensure that departments are able to identify where there is a need for advice, frame appropriate questions, understand and critically review the advice given, and act upon it in a sensible and proportionate manner."

The Government's commitment to carry out a review was again set out in its interim response with an additional pledge to seek wider consultation.

47. Devolution must not be allowed to weaken the UK science base. The Government must ensure that the devolved administrations are fully involved in the development of science policy in order to avoid inconsistency of purpose in the different parts of the UK. (Paragraph 78)

The Government agrees that it is important to maintain a fully integrated, UK-wide science base. A key objective of science policy is to maintain and develop the UK's world-class science and engineering base, funded through the Dual Support system. This includes the Funding Councils of the devolved administrations, and their Education Departments, whose representatives meet with those of the Research Councils under the auspices of the Science & Engineering Base Co-ordinating Committee chaired by the Government's Chief Scientific Adviser.

⁵ "The BSE Inquiry" - Report by Lord Phillips of Worth Matravers, Mrs June Bridgeman CB and Professor Malcolm Ferguson-Smith FRS, October 2000 and the *Government's Interim Response*, February 2001.

The Research Councils also include members from both the devolved administrations and universities in their countries who are involved in their policy development and priority setting. For example, the Chief Medical Officer for Scotland is a member of the Medical Research Council.

48. We recommend that the Office of Science and Technology update its report measuring the quality of the UK Science Base on a regular basis. (Paragraph 79)

OST's measurements of the quality of the UK Science Base derive principally from bibliometric data published annually by the Institute of Scientific Information (ISI) in Philadelphia. The latest measures were reported in DTI's Expenditure Plans Report.⁶ It is planned to publish updates of these measures as soon as the necessary analysis of each new set of ISI data has been carried out. This is expected to be in July of each year.

49. Sustained and substantial funding of the science base will be required to ensure that the UK can continue to 'punch above its weight'. (Paragraph 79)

The Government has already made clear its commitment to properly funding the science and engineering base by injecting large increases into the Science Budget in 1998 and again in 2000 following two spending reviews. In 1998, science received a larger percentage increase in funding than any single government department. In the years 2001-02 to 2003-04 the Science Budget will grow by an average of 7% per year in real terms. These increases have been channelled into all the key areas of science funding: increasing the volume of basic research, restoring the underlying physical infrastructure base, increasing PhD stipend levels substantially, and increasing funding of knowledge transfer and exploitation activities. The Government remains committed to the proper funding of a vital and healthy science base in the long term.

50. We are yet to see hard evidence that the policies introduced by *Realising Our Potential* have had a significant impact on investment in science and innovation. (Paragraph 80)

While it is accepted that UK R&D expenditure declined from 1993 to 1998, the trends have now been reversed. In 1999 overall UK R&D expenditure increased by 4% in real terms⁷ and business R&D expenditure increased by 7% in real terms.⁸ In addition, the 1997 Comprehensive Spending Review and Spending Review 2000 are having a positive impact on areas of Government R&D expenditure from 1999/2000 onwards, whilst the White Paper *Excellence and Opportunity* has introduced measures which will expand the opportunities for innovation. These changes reflect the importance which Government attaches to investment in science and innovation.

⁶ *Trade and Industry: The Government's Expenditure Plans 2001-02 to 2003-04 and Main Estimates 2001-02*, (Cm 5112) pages 23 and 82.

⁷ Gross expenditure on R&D increased in real terms from £14.27 billion (1.81% of GDP) in 1998 to £14.91 billion (1.84% of GDP) in 1999.

⁸ Business Enterprise R&D increased in real terms from £9.4 billion (1.19% of GDP) in 1998 to £10.11 billion (1.25% of GDP) in 1999.

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